

REMARKS

Claims 3, 13 and 25 having been indicated as allowable, Claims 1, 2, 4-12, 14-24 and 26-64 are now presented for examination. Claims 1, 2, 5, 11, 12, 23, 24, 27, 35, 38, 39, 44, 45, 49, 52 and 53 have been amended to define still more clearly what Applicants regard as their invention, in terms which distinguish over the art of record. Independent Claims 63 and 64 have been added to assure Applicants of the full measure of protection to which they deem themselves entitled. Claims 1, 2, 11, 12, 23, 24, 63 and 64 are the only independent claims under consideration.

Claims 5, 27, 35, 38, 39, 44, 45, 49, 52 and 53 have been objected to as being dependent upon a rejected base claim and would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 5, 35, 38, 39 have been amended to incorporate the limitations of independent Claim 1. Claims 27 and 49 have been amended to incorporate the limitations of independent Claim 23. Claims 44 and 45 have been amended to incorporate the limitations of independent Claim 12. Claims 52 and 53 have been amended to incorporate the limitations of independent Claim 24 and Claims 63 and 64 have been added to correspond to Claims 38 and 39 incorporating the limitations of independent Claim 2. Accordingly, it is believed that Claims 5, 27, 35, 38, 39, 44, 45, 49, 52 and 53 as amended by this amendment and newly added Claims 63 and 64 are allowable.

Claims 1, 2, 4, 6-12, 14-24, 26, 28-34, 36, 37, 40-43, 46-48, 50, 51 and 54-62 have been rejected under 35 U.S.C. § 103(a) as unpatentable over U.S. Patent 6,372,646 (Ohmi

et al.) in view of U.S. Patent 5,349,604 (Nakata). With regard to the claims as amended by this amendment, this rejection is respectfully traversed.

Independent Claim 1 as amended by this amendment is directed to an illuminator that illuminates an object with luminous flux emitted from a light source. The illuminator has an illumination system through which the luminous flux is projected onto the object and has plural surfaces including a surface of a unit onto a portion of which a titanium oxide film that absorbs ultraviolet light is applied. The portion is removed from the optical axis of the illumination system.

Independent Claim 2 as amended by this amendment is directed to an illuminator that illuminates an object with a luminous flux emitted from a light source. In the illuminator, an illumination system through which the luminous flux is projected onto an object has plural optical units. At least one of the plural optical units has a surface onto at least a portion of which a titanium oxide film that absorbs ultraviolet light is applied. The portion is removed from the optical axis of the illumination system.

Independent Claim 11 as amended by this amendment is directed to exposure apparatus that exposes a wafer with a pattern formed on a mask. In the exposure apparatus, an illumination system that illuminates the mask with light from a light source has plural surfaces including a surface onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied. The portion is removed from the optical axis of the illumination system.

Independent Claim 12 as amended by this amendment is directed to exposure apparatus that exposes a wafer with a pattern formed on a mask. In the exposure apparatus, an illumination system that illuminates the mask with light from a light source has plural optical units. At least one of the plural optical units has a surface onto at least a portion of which a

titanium oxide film absorbing ultraviolet light is applied. The portion is removed from the optical axis of the illumination system.

Independent Claim 23 as amended by this amendment is directed to a projection aligner that illuminates a pattern formed on a mask with luminous flux and projects the pattern onto a wafer. In the projection aligner, an illumination system passes through the luminous flux and a projection system projects the pattern onto the wafer. The illumination system and the projection system have plural surfaces including at least one surface of a unit onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied. The portion is removed from the optical axis of the illumination system.

Independent Claim 24 as amended by this amendment is directed to a projection aligner that illuminates a pattern formed on a mask with luminous flux and projects the pattern onto a wafer. In the projection aligner, an illumination system through which the luminous flux passes has plural optical units and a projection system that projects the pattern onto the wafer has plural optical units. At least one of the plural optical units of at least one of the illumination system and the projection system has a surface onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied. The portion is removed from the optical axis of the illumination system.

In Applicants' view, Ohmi et al. discloses an exposure apparatus having an illumination light source and a stage for an exposed object to be mounted thereon. In the exposure apparatus, at least one of an illumination optical system and a projection optical system includes a plurality of optical articles. In each optical article, a first optically transparent thin layer and a second optically transparent thin layer having a higher refractive index than that of the first optically transparent thin layer are laminated on a surface of a substrate. At least one of

the first and second optically transparent thin layers includes a layer of oxides or fluorides and atoms of at least one selected from the group consisting of krypton, xenon and radon, in which the content of the atoms is within a range of from 0.5 atomic ppm to 1 atomic %, inclusive.

In Applicants' opinion, Nakata discloses a semiconductor laser source in which a laser diode and a lens are fixed onto a laser fixing member. A laser beam emitted from the laser diode passes through the lens, and a part of the laser beam passes through a pinhole provided to a beam restricting plate. The pinhole is formed so that its diameter is smaller than the laser beam diameter at the beam restricting plate. The laser beam is transmitted therethrough while being diffracted.

In accordance with the invention defined in Claims 1, 2, 11, 12, 23 and 24, a titanium dioxide film that absorbs ultraviolet light is applied to a portion of a surface of an illumination and/or projection system which portion is removed from the optical axis of the illumination and/or projection system.

Ohmi et al. may teach an optical system in which the light used is ultraviolet light. As recognized by the Examiner, Ohmi et al. does not disclose a surface onto a portion of which a titanium oxide film is absorbing ultraviolet light is applied. Nakata at lines 40 through 46 of column 1 teaches that a lens is anti-reflection coated by "by setting a plurality of lenses one by one at a planetary in a vacuum chamber and then applying to them a multi-layer coating including magnesium fluoride and titanium dioxide." The process of Nakata coats the entire surface of the lens so that the lens is anti-reflection coated with a multilayer coating including magnesium fluoride and titanium dioxide to prevent generation of nonuniformity of the beam intensity. Accordingly, it is not seen that Nakata in any manner teaches or suggests the feature of Claims 1, 2, 11, 12, 23 and 24 of having a titanium oxide film applied to a surface portion of

an illumination system and/or projection system which surface portion is removed from the optical axis of the system.

With regard to the cited combination of Ohmi et al. and Nakata, Ohmi et al. is devoid of any suggestion of a surface of an illumination system onto a portion of which a titanium oxide film is applied. Nakata fails to suggest coating a only a portion of an illumination system surface removed from the system optical axis. It is therefore not seen that the addition of Nakata's coating of the entire surface of lenses at a planetary in a vacuum chamber with magnesium fluoride and titanium dioxide to provide lenses with anti-reflection surfaces to Ohmi et al.'s arrangement which projects ultraviolet light through plural surfaces of an illumination system could possibly suggest the feature of Claims 1, 2, 11, 12, 23 and 24 applying ultraviolet light absorbing titanium oxide to portions of surfaces of an illumination system removed from the system optical axis. It is therefore believed that Claims 1, 2, 11, 12, 23 and 24 as amended by this amendment are completely distinguished from any combination of Ohmi et al. and Nakata and are allowable.

A review of the other art of record has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record. Applicants submit that the amendments to independent Claims 1, 2, 11, 12, 23, 24 and the amendments to now independent Claims 5, 27, 35, 38, 39, 44, 45, 49, 52 and 53 and addition of Claims 63 and 64 clarify Applicants' invention and serve to reduce any issues for appeal.


The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons.

Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration or reconsideration, as the case may be, of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable consideration and reconsideration and early passage to issue of the present application. The Examiner is respectfully requested to enter this Amendment After Final Action under 37 C.F.R. § 1.116.

Applicant's attorney, Steven E. Warner, may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



Attorney for Applicant
Jack S. Cubert
Registration No. 24,245

FITZPATRICK, CELLA, HARPER & SCINTO
30 Rockefeller Plaza
New York, New York 10112-3801
Facsimile: (212) 218-2200

VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE CLAIMS

1. (Five Times Amended) An illuminator for illuminating an object with a luminous flux emitted from a light source, said illuminator comprising:

an illumination system through which the luminous flux is projected onto the object, said illumination system having plural surfaces including a surface of a unit onto a portion of which a titanium oxide film absorbing ultraviolet light is applied, the portion being removed from an optical axis of the illumination system.

2. (Five Times Amended) An illuminator for illuminating an object with a luminous flux emitted from a light source, said illuminator comprising:

an illumination system through which the luminous flux is projected onto the object, said illumination system including a plurality of optical units, at least one of said plurality of optical units having a surface onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied, the portion being removed from an optical axis of the illumination system.

5. (Twice Amended) An illuminator [according to claim 1,] for illuminating an object with a luminous flux emitted from a light source, said illuminator comprising:

an illumination system through which the luminous flux is projected onto the object, said illumination system having plural surfaces including a surface onto a portion of

which a titanium oxide film absorbing ultraviolet light is applied, wherein a unit of said illumination system comprises at least a diaphragm.

11. (Five Times Amended) An exposure apparatus for exposing a wafer with a pattern formed on a mask, said exposure apparatus comprising:

an illumination system for illuminating the mask with light from a light source,
said illumination system having plural surfaces including a surface of a unit onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied, the portion being removed from an optical axis of the illumination system.

12. (Five Times Amended) An exposure apparatus for exposing a wafer with a pattern formed on a mask, said exposure apparatus comprising:

an illumination system for illuminating the mask with light from a light source,
said illuminating system having a plurality of optical units, at least one of said plurality of optical units having a surface onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied, the portion being removed from an optical axis of the illumination system.

23. (Five Times Amended) A projection aligner for illuminating a pattern formed on a mask with a luminous flux and projecting the pattern onto a wafer, said projection aligner comprising:

an illumination system through which the luminous flux is passed; and

a projection system for projecting the pattern onto the wafer,
wherein said illumination system and said projection system have plural surfaces including at least one surface of a unit onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied, the portion being removed from an optical axis of the illumination system.

24. (Five Times Amended) A projection aligner for illuminating a pattern formed on a mask with a luminous flux and projecting the pattern onto the wafer, said projection aligner comprising:

an illumination system through which the luminous flux is passed, said illumination system including a plurality of optical units; and

a projection system for projecting the pattern onto the wafer, said projection system including a plurality of optical units,

wherein at least one of said plurality of optical units of at least one of said illumination system and said projection system has a surface onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied, the portion being removed from an optical axis of the illumination system.

27. (Twice Amended) A projection aligner [according to claim 23,] for illuminating a pattern formed on a mask with a luminous flux and projecting the pattern onto a wafer, said projection aligner comprising:

an illumination system through which the luminous flux is passed; and

a projection system for projecting the pattern onto the wafer,
wherein said illumination system and said projection system have plural surfaces
including at least one surface onto at least a portion of which a titanium oxide film absorbing
ultraviolet light is applied, and
wherein [said] a unit of at least one of said illumination system and said
projection system comprises at least a diaphragm.

35. (Amended) An illuminator [according to claim 1,] for illuminating an object
with a luminous flux emitted from a light source, said illuminator comprising:

an illumination system through which the luminous flux is projected onto
the object, said illumination system having plural surfaces including a surface onto a portion of
which a titanium oxide film absorbing ultraviolet light is applied,

wherein [said] a unit of said illumination system comprises at least a
shutter.

38. (Amended) An illuminator [according to either claim 1 or 2,] for
illuminating an object with a luminous flux emitted from a light source, said illuminator
comprising:

an illumination system through which the luminous flux is projected onto
the object, said illumination system having plural surfaces including a surface onto a portion of
which a titanium oxide film absorbing ultraviolet light is applied,

wherein [said] a unit of said illumination system comprises at least a prism.

39. (Amended) An illuminator [according to either claim 1 or 2,] for illuminating an object with a luminous flux emitted from a light source, said illuminator comprising:

an illumination system through which the luminous flux is projected onto the object, said illumination system having plural surfaces including a surface onto a portion of which a titanium oxide film absorbing ultraviolet light is applied,

wherein [said] a unit of said illumination system comprises at least a filter.

44. (Amended) An exposure apparatus [according to claim 12,] for exposing a wafer with a pattern formed on a mask, said exposure apparatus comprising:

an illumination system for illuminating the mask with light from a light source,

said illuminating system having a plurality of optical units, at least one of said plurality of optical units having a surface onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied,

wherein said optical unit comprises at least a prism.

45. (Amended) An exposure apparatus [according to claim 12,] for exposing a wafer with a pattern formed on a mask, said exposure apparatus comprising:

an illumination system for illuminating the mask with light from a light source,

said illuminating system having a plurality of optical units, at least one of said plurality of optical units having a surface onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied,

wherein said optical unit comprises at least a filter.

49. (Amended) A projection aligner [according to claim 23,] for illuminating a pattern formed on a mask with a luminous flux and projecting the pattern onto a wafer, said projection aligner comprising:

an illumination system through which the luminous flux is passed; and

a projection system for projecting the pattern onto the wafer,

wherein said illumination system and said projection system have plural surfaces including at least one surface of a unit onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied, and

wherein said unit comprises at least a shutter.

52. (Twice Amended) A projection aligner [according to claim 24,] for illuminating a pattern formed on a mask with a luminous flux and projecting the pattern onto the wafer, said projection aligner comprising:

an illumination system through which the luminous flux is passed, said illumination system including a plurality of optical units; and

a projection system for projecting the pattern onto the wafer, said projection system including a plurality of optical units,

wherein at least one of said plurality of optical units of at least one of said illumination system and said projection system has a surface onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied, and

wherein said optical unit comprises at least a prism.

53. (Twice Amended) A projection aligner [according to claim 24,] for illuminating a pattern formed on a mask with a luminous flux and projecting the pattern onto the wafer, said projection aligner comprising:

an illumination system through which the luminous flux is passed, said illumination system including a plurality of optical units; and

a projection system for projecting the pattern onto the wafer, said projection system including a plurality of optical units,

wherein at least one of said plurality of optical units of at least one of said illumination system and said projection system has a surface onto at least a portion of which a titanium oxide film absorbing ultraviolet light is applied, and

wherein said optical unit comprises at least a prism.